THE SCIENCE NEWS-LETTER

A Weekly Summary of Current Science

EDITED BY WATSON DAVIS

ISSUED BY
SCIENCE SERVICE
1115 Connecticut Avenue
WASHINGTON, D. C.

EDWIN E. SLOSSON, Director
WATSON DAVIS, Managing Editor

SUBSCRIPTION: $5 A YEAR, POSTPAID

Vol. II, No. 109 Saturday, May 12, 1923

VELOCITY OF LIGHT A TAPE TO MEASURE EARTHLY DISTANCE

A new method for the measurement of distance, depending upon the velocity of light, was predicted as a possibility by Prof. A. A. Michelson of the University of Chicago, measurer of the size of distant stars, at a recent lecture in Washington. It would, he said, make possible the measurement of the distances of inaccessible points without the use of a tape line at any stage of the process.

The new method is hoped to be a sequel of a most accurate redetermination of the velocity of light which Prof. Michelson hopes to carry out this summer at the Mt. Wilson observatory in California. The velocity is known to be approximately 186,500 miles a second, but this is not accurate enough for Prof. Michelson, who confessed that he hoped to get the velocity accurately to within a mile.

This would be to within one part in 186,500. If then, the velocity of light were known so exactly it would be possible, by using such apparatus, to measure the time light took to go to and from the distant point to be measured and so determine its distance with an error of not more than three-tenths of an inch in a mile, which is as accurate as all except the most painstaking surveys.

Dr. Michelson showed a model of his new "interferometer" constructed to measure the size of many stars more distant than the now famous Betelgeuse which by means of a smaller instrument he found to have a diameter approximately 300 times that of our sun, 244,000,000 miles. Since then the star Antares, a red star plainly visible low in the southern sky during summer evenings, has been found to have a diameter nearly twice as great, or 420 millions of miles.

The interferometer is an instrument based on a simple principle, which makes use of a property of light waves similar to one of sound waves. If two tuning forks vibrating at different rates are heard together the waves "interfere" and at times an increase of sound and at other times silence results. Similarly if light waves can be made to interfere, a series of bands, or "interference fringes" of alternate light and darkness is produced.

These are observed if a star is viewed through a telescope the main lens of which is covered except for two small holes on either side. Where the image of the star would ordinarily be there is then seen a band of these fringes. Now the key to all this is that there is a mathematical relation between the distance apart of these two holes in the shutter of the lens, the size and distance apart of the "fringes", and the apparent diameter of the distant star. If that and its distance are known, the real diameter may be easily calculated.

Prof. Michelson's epoch-making work was based on the discovery that the same result might be obtained if the light of the star were taken from two points several feet instead of inches apart, and by means of mirrors reflected into a telescope. These two beams then interfere, producing the same phenomenon as formerly seen. But here is the point. By placing the two mirrors, say 20 feet apart, the effect for this purpose is the same as if a telescope with a main lens of more than 20 feet in diameter had been used. With such a lens, many stars now seen only as points of light would appear as disks large enough to measure.

Dr. Michelson's first work, resulting in the measurement of Betelgeuse, was done with a 20 foot interferometer. The work which he proposes to do this summer will be done with the new 50 foot instrument of proportionately greater power, and most interesting results are expected.

Dr. Michelson confessed that he did not know how to pronounce the name of Betelgeuse, the star which he made famous. "I usually get around it by calling it by its astronomical name, 'Alpha Orionis'," he said.

READING REFERENCES- Michelson, Albert A. The velocity of light. Chicago, University of Chicago Press, 1902.

DISTANCE OF BETELGEUSE ACCURATELY DETERMINED

The astronomers have finally taken the measure and determined the distance of Betelgeuse, the giant red star in the constellation of Orion. At the recent meeting of the National Academy of Sciences, Dr. S. A. Mitchell, director of the Leander McCormick observatory at the University of Virginia, announced that the distance of this mighty sun from the earth had been calculated to be 175 light years. With the measurements of the apparent diameter of Betelgeuse made about two years ago by Prof. A. A. Michelson of the University of Chicago this makes possible the determination of the actual diameter of the star, which is found to be 242,000,000 miles.

A light year is the distance which light, traveling at a velocity of 186,000 miles in a second, traverses in a year. Light takes about eight minutes to come from the sun. The distance of Betelgeuse is so vast a number of miles that it is best understood by reducing the scale of measurement. If the distance of the sun from the earth be taken as one inch, making the diameter of our solar system across the orbit of Neptune, the outermost planet, some five feet and a half, then the great star in Orion would be 175 miles away.

On the same scale the Sun would be a mere grain of dust one-hundredth of an inch in diameter, while Betelgeuse would be somewhere between the sizes of a golf ball and a tennis ball.

The announcement of the distance of Betelgeuse as measured at the University of Virginia was part of an announcement by Dr. Mitchell of determinations of the distances of some 600 stars. The distance of the giant in Orion corresponds exactly with the average of observations previously made at the Mt. Wilson observatory in California, and at other noted observatories.

Measurement of the distances of the stars is made on exactly the same principle as is used by a surveyor to measure the distance across a river he cannot cross, or by a range-finder to determine the distance of an enemy vessel at sea. Every-

body knows that the same thing looked at from varying positions of view has a varying background. If a line be measured and the distant object viewed from the two ends of it and the angles which it makes with that "base line" accurately measured, the distance may easily be calculated by trigonometry.

That is the way the astronomers measure the distance of the stars. The only difficulty is getting a long enough base line. The biggest base line obtainable is the diameter of the earth's orbit, some 186,000,000 miles, but as against the vast distances of stellar space this is almost too minute to use as a measuring rod. The variation in the position of Betelgeuse at the extremes of this distance amounts to about as much as that of 21 inches seen at a distance of 4,000 miles. In the case of a star this angle is called the "parallax". These determinations are taken six months apart for each star since the earth is then at opposite sides of its orbit.

The work of the Leander McCormick observatory under Dr. Mitchell's direction in measuring the distances of 600 stars is considered of great importance, as up until about 10 years ago the distances of not more than 100 were known with approximate accuracy. Distance measurements are essential to all determinations of a star's real diameter and motion through space, and are of great value in determining the velocity and direction of the motion of our own sun, carrying with it the earth and its brother planets through the pathless abysses of space.

READING REFERENCES- Turner, Herbert Hall. Giant suns. In Smithsonian Institution, annual report, 1920. Washington, 1922.

Dr. Edwin E. Slosson

CHATS ON SCIENCE

THE ECLIPSE AND EINSTEIN

The development of a batch of photographic plates is often awaited with impatience and anxiety. In the case of an amateur the impatience is manifested by the snapshotters and the anxiety by his sitters.

But perhaps never before have so many people in all parts of the world been eager to learn "how the plates turned out" as in the case of those brought back from Australia by Dr. W. W. Campbell, the man who observes the movements of the heavenly bodies by night at the Lick Observatory and by day controls the movements of the students at the University of California.

For these negatives taken during the eclipse of September 21 contained the evidence for or against the Einstein theory of relativity which has excited the interest of all astronomers and, for various reasons, an unexpectedly large proportion of the public. The less people understood it the more eager they were to hear about it.

The man who manifested the least anxiety about the results of the eclipse expedition was apparently Einstein himself, for having made up his mind eight years ago how the heavenly bodies must behave he remains serenely indifferent to the efforts of astronomers to find out how they do behave. It followed as a logical deduction from his theory of the relativity of all measurements in space and time

that a ray of light passing close to the sun would be drawn out of its straight course as though the light were attracted by the pressure of such a heavy mass. And since the path of the ray is drawn inward toward the sun an observer on the earth looking back up the ray would see the star as though it were moved outward from the sun. If a photograph of a group of stars taken with the sun in the middl is compared with a photograph of the same group without the sun, the images of the stars in the former case will seem to have been displaced from their ordinary positions in the sky. The stars nearest the sun's disk will naturally seem to have moved out the most. The effect is the same as you have noticed when a patron of the bootleggers gets aboard a crowded street car. All move away from him and those nearest the obnoxious individual move farthest.

Nobody had discovered or suspected such a displacement of star images about the sun until Einstein predicted it from his mathematical theory. As figured out from his formula, a ray of starlight just grazing the sun's disk would be deflected toward the sunny side to the extent of 1.75 seconds of arc. The star images further away would be displaced less according to their apparent distance from the sun.

Of course, the stars cannot be photographed when the sun is shining into the telescope so one must wait till the sun is totally shielded from the earth by the moon. The British astronomers took advantage of the first opportunity to put the Einstein theory to the test, the eclipse of 1919, and they came back from South America and Africa with the report that the star images were dispersed as Einstein has predicted. But they had good photographs of seven stars only and have been sharply criticized in scientific circles. Since the experiment could not be repeated until the next eclipse, astronomers had to hold their breath for four years or waste it in vain disputes.

But now that President Campbell has explained to the American Philosophical Society of Philadelphia and the National Academy of Sciences at Washington the results of his observations in Australia there is little ground left for skepticism on this point. Instead of seven stars he has five sets of plates containing from sixty-two to eighty-four star images and when these are measured with the micrometer and calculated to a common position at the edge of the sun the mean is 1.74 seconds of arc which is almost exactly the deflection predicted by Einstein. The negatives are 17 inches square and it took Dr. Campbell fifty hours of working time to measure up the stars on a single eclipse plate in comparison with one of the same section of the sky at other times.

The same plates were measured by different astronomers who could not know what the results would be until they were finally figured out. Check plates taken of other stars show that the displacement images cannot be due to any defects of the telescope or sensitive plates. The Canadian eclipse expedition also obtained observations confirming the Einstein theory.

So certain does Dr. Campbell feel of these conclusions that the Lick Observatory will not devote further effort to the verification of the Einstein theory although the next eclipse comes in California September 10. The British astronomers had previously announced that they would not send out an expedition to observe the coming eclipse if the results of the Lick expedition to Australia last year settled the matter satisfactorily. This it seems to have done, but there are enough other unsettled problems in the relativity theory to keep the scientists busy for many years.

READING REFERENCES- Einstein, Albert. Relativity. New York, Henry Holt and Co., 1920. Slosson, E. E. Easy Lessons in Einstein. New York, Harcourt, Brace and Co., 1920.

SUN DISINTEGRATING ECLIPSE PHOTOS SHOW

Our sun is disintegrating, Dr. W. W. Campbell of Lick Observatory told the National Academy of Sciences meeting recently held. Photographs of its corona made at different stations during total eclipses last year and 1918 show that the sun is continuously throwing off fine particles of matter in all directions. These are driven away from the sun's surface by the force of light. Comets are similarly known to waste away as they pass around the sun. Halley's comet lost part of its tail on its last visit to our solar system. The discoveries of Campbell on the composition of the corona aroused almost as much interest here as his confirmation of the Einstein theory from the photographs taken in Australia last September by the Lick expedition.

By previous arrangement, two expeditions in 1918, one in California and one in Colorado, photographed the corona and a comparison of the plates showed that a portion of the corona had moved outward. The same experiment was duplicated in September, 1922 by the Lick Observatory at Walla on the west coast of Australia, and an Australian expedition at the center of that continent. A rigorous comparison of these plates has not yet been made.

BUREAU OF STANDARDS ADDS TO LIFE OF AUTO BATTERIES

Owners of automobiles and home lighting and power plants who have lost time and temper by the failure of batteries at critical times may be encouraged by a research now in progress at the Bureau of Standards under the direction of Dr. G. W. Vinal to determine how the batteries get that way. The trouble is frequently due to small impurities in the acid used and specifications, easily maintained, will be prepared which are expected to prevent difficulties due to this cause.

One part of platinum in a million of the acid will greatly shorten the active life of the battery. Iron also has a bad effect. Platinum used to be a common impurity when sulphuric acid manufacturers distilled the product in platinum stills. These have become so enormously expensive that silica stills are being used, avoiding this minute impurity. Small amounts of iron are still a problem.

Studies are also being made on the efficiency of commercial electrolytes sold under trade names and frequently colored attractive and gaudy hues. Some of these are quite damaging to batteries because of impurities present in them, Dr. Vinal said.

Tests are also being made of commercial batteries of common use, only about half of which came up to the standards set by the Bureau of Standards for performance of the batteries used in the various branches of the military and civil service.

AMATEUR RADIO MESSAGES TO PENETRATE ARCTIC WITH MACMILLAN

Loneliness, one of the worst terrors to those who explore the frozen north, is to be banished by radio. Donald B. MacMillan, noted explorer, has made arrangements with Hiram Percy Maxim, president of the American Radio Relay League, by which members of his seventh polar expedition, sailing from Booth Bay, Maine, about June 15, will keep in touch with civilization and their loved ones.

According to the agreement reached, the League will provide the expedition with an expert amateur operator. Instead of the usual agonizing months of waiting cut off from the rest of the world, it is planned to relay radio messages through American amateur stations to and from the exploring party and their relatives at least once a week until the expedition gets within twelve degrees of the Pole itself. The operator accompanying the expedition will listen for amateur signal and will send weekly a complete list of amateur stations heard by him.

Letters have been sent to members of the American Radio Relay League asking them to submit the names of likely candidates for the position of operator with the polar party. From these three will be chosen to be interviewed by Mr. MacMillan, who will select one of them to accompany him. The candidates must be thoroughly trained operators with a knowledge of tube transmitters and short wave communication. They must be familiar with the sea and willing to do any task which may be required of them. The winner's disposition must be such that he can live with five or six men during the entire period of the exploration, Dr. MacMillan emphasized.

CHEMICALLY ANALYZE THE MILKY WAY

The great Henry Draper Catalogue of stellar spectra will be extended to include thousands of faint stars, especially those along the central line of the Milky Way, according to an announcement made by the Harvard College Observatory, which has carried on, for more than twenty years, the classification of the heavenly bodies on the basis of chemical constitution.

In the analysis and classification of a star the light is resolved by means of a stellar spectroscope, an instrument used in various forms but in its simplest arrangement comprising a prism of glass mounted in front of a photographic telescope. Many different telescopes and prisms were used in collecting the photographs of stellar spectra used in the compilation of the Draper Catalogue. The work was made possible through gifts by Dr. and Mrs. Henry Draper of New York.

When the light of stars is analyzed with the spectroscope they are found to differ very greatly from each other. For the hottest stars the elements hydrogen and helium predominate in the radiative layers of the stellar atmospheres. For the stars of intermediate temperatures, such as the sun, the metallic elements like iron, nickel, calcium, and sodium are indicated in the hot vapors; and for the cooler and redder stars chemical compounds appear. The Harvard classification, which is universally used by astronomers, recognizes more than thirty types.

For the southern stars in the Draper Catalogue the photographs were made at Arequipa, Peru. The high altitude of that station made it possible to photograph much fainter stars than an instrument of equal power could photograph at the central station of the Observatory in Cambridge. As a consequence, the northern stars are less completely known than those south of the celestial equator, and improved photographs of these northern regions are now being made for the extension of the great catalogue.

Since a very large majority of the fainter stars is concentrated into that band of light known as the Milky Way, the Harvard observers will confine their future classification work largely to the regions along the central line of the Milky Way. It is announced that some of the new photographs will permit the classification of five to ten times as many stars as could be included from the early photographs.

The original catalogue is in constant use at all observatories. It is published in the Annals of the Harvard College Observatory in nine large quarto volumes the last two of which are being printed this year. The entire catalogue gives the chemical classification of nearly a quarter of a million stars.

The extension of this analysis of the stars will include not only a record of the type of spectrum and the position of the stars, but also a new determination of their brightness. It is found that the labor of determining accurately the brightness of these faint Milky Way stars is greater than that of their classification into spectral types, and will involve the making of hundreds of photographs with the Harvard telescopes. The work of extension is being undertaken under the direction of Prof. Harlow Shapley, director of the Harvard Observatory, and the classification of the spectra will be made, as previously for the main catalogue by Miss Annie J. Cannon.

READING REFERENCES- Hale, George E. The new heavens. New York, Charles Scribner's Sons, 1922. Harvard University, Observatory. The Drake catalogue of stellar spectra photographed with the 8-inch Bache telescope as a part of the Henry Draper memorial, Cambridge, J. Wilson and Son, 1890. Kapteyn, Jacobus Cornelius and Van Rhijn, P. J., On the distribution of the stars in space especially in the high galactic latitudes. Chicago, Reprint from the Astrophysical Journal. Vol .III, 1920.

WOULD'ST BE THIN? PICK THIN PARENTS

Fat men are born, not made, according to Dr. C. B. Davenport, director of the Station for Experimental Evolution at Cold Spring Harbor, N. Y., who spoke before the recent meeting of the National Academy of Sciences on "Heredity in Body Build". According to his statement, the only safe and sure way to be always slim and sylphlike in figure was to have parents who were slender in build.

It is not altogether a matter of what one eats or how much, said Dr. Davenport calling attention to the habits of the Aberdeen-Angus and Jersey cattle, the former of which are big eaters and put on weight easily while the Jerseys even if given all the food they want always remain slight and slender. The quality which turns food into fat was hereditary, he said.

Diagrams of fat and thin families were shown, one of the families given to avoirdupois culminating in two daughters whose weight was respectively 300 and 350 pounds. But fat persons may have slender children, or rather children who will always remain slender, Dr. Davenport asserted. On the other hand, children of two thin persons will never grow fat.

Dr. Davenport's conclusions were questioned to some extent by Prof. Graham Lusk of the Cornell University Medical School, who asserted that appetite and nutrition had much to do with putting on weight.

"If a man drinks one-third of a glass of milk above his nutritional requirements every day, he will gain 9 pounds in a year and 90 pounds in 10 years", he said. "Appetite has much to do with it. We have hot summers in this country, a man has little appetite during them, and a fat man in hot weather can not do his work as well as a thin one. That is why the typical American, 'Uncle Sam', is thin, while the Britisher, typified by 'John Bull', is portly."

READING REFERENCES- MacDowell, Edwin Carleton. Size inheritance in rabbits. Washington, D. C. Carnegie Institution of Washington, 1914. McCollum, E. V. The newer knowledge of nutrition. New York, MacMillan Company, 1922.

T. N. T. MISTAKEN FOR ORE; PUBLIC CAUTIONED

The public in general and prospectors in particular are warned by Dr. F. N. Guild of the University of Arizona to look out for samples of T. N. T. which have escaped from captivity and are lying loosely about the scenery of many western states. Pieces of the explosive which have weathered for a time resemble fragments of rock, he said.

Large quantities of the explosive which were left over from the war were distributed by the national government to the several states, principally for use in bridge and road building. Familiarity bred contempt and in many cases the material was stacked up in loose boxes without guard or protection of any kind. In such cases pieces of weathered T. N. T. of a rusty brown color have been picked up many feet from where the boxes stood.

In one case a prospector sent to the Bureau of Mines a sample of "rock" which was beyond his power of analysis with a request to tell him what it was. The "rock" was almost pure T. N. T., mixed with a small amount of earthy impurity.

BOTTLE DRIFTS ACROSS PACIFIC IN TWO YEARS

An astonishingly rapid migration of an empty, sealed bottle, cast overboard at sea, is reported by the U. S. Hydrographic Office. Enclosing nothing but a "bottle paper" on which directions for its return were printed in seven languages, the bottle was put overboard from the S. S. West Isleta in the Pacific Ocean about 100 miles off the Central American coast on the last day of the year 1920.

The little wayfarer of the seas was picked up on Miscol island, northwest of New Guinea, just about 8,400 miles across the whole width of the Pacific, on January 23 or this year. That would give an average drift of about 11 miles a day, assuming the bottle to have taken the shortest line, to have made no stopovers along the strands of the alluring South Sea islands, and to have been picked up immediately on its arrival at Miscol. This, the Hydrographic Office, knowing the habits of bottles and of the South Seas, considers improbable.

Bottles have been known to make long, long journeys, but this ocean hobo is considered to have achieved something like a record.

NEW GIANT REPTILES FOUND IN CANADA'S FOSSIL SWAMPS

Out of the mists of millions of years past, fearsome reptilian monsters continue to emerge. Three hitherto unknown dinosaurs, fossil remains of which were dug up in western Alberta, Canada, have in the last few weeks been identified for the Dominion government by Charles W. Gilmore, paleontologist, of the U. S. National Museum. The University of Toronto is equipping an expedition to hunt more of these prehistoric lizards during the coming summer, said Mr. Gilmore, who has just returned from Ottawa.

The three new species identified belonged to the general class known as duckbill dinosaurs. These huge long-necked reptiles walked on their two hind feet and balanced their heavy godies with their big tails. They had very small brains, smaller in proportion than any known vertebrate animal, Mr. Gilmore said, and were

probably very slow in movement. The largest of the three was about thirty-five feet long from end of head to tip of tail and probably stood about fifteen feet high.

Although the country surrounding the bad lands where the fossils were found is now a high plain, at the time these reptiles lived the evidence of the rocks indicates it was low and swampy. Mr. Gilmore predicts that many more new forms will probably be discovered in the Alberta deposits, which have been worked for years and were the richest so far found in America, and elsewhere on this continen

---

ALCOHOL BEING TESTED FOR AIRCRAFT ENGINES

Alcohol as a motor fuel is now being used in extensive tests carried on by the Bureau of Aeronautics of the Navy Department. The alcohol is not used alone, however, but is added to the high grade aviation gasoline in the proportion of 30 percent absolute alcohol and 70 per cent gasoline. The purpose is principally to prevent "knocking", the alcohol being used as a substitute for benzene which has formerly been employed to some extent. The experiments are described by Henry A. Gardner for the Bureau of Aeronautics in the May number of the Journal of Industrial and Engineering Chemistry.

"Gasoline, even of the highest grade aviation type, is not entirely satisfactory as a motor fuel, at least for aircraft," it is stated. "Detonation troubles have been serious. It is not economical because it can not be used effectively at high compressions, as such compressions - say 7:1 - are obtainable from a practical standpoint only when detonation can be prevented."

The use of alcohol is declared to be preferable to that of benzene because it can be produced in unlimited quantities while the supply of benzene is limited; and because it is believed that there will be less motor corrosion from its use. It is stated to be equal as an "anti-knock" to various metallic ethyl compounds recently studied which at high compressions have a bad effect upon spark plugs.

One objection so far found to the alcohol is that if the alcohol-gasoline mixture be permitted to stand for over 10 hours outdoors in an uncovered container, it absorbs enough water to cause the separation of the two constituents. Tests are continuing on a large scale, several thousand gallons having been prepared for navy use.

BLUE HEAT LATEST FIND OF SCIENCE

"Blue heat" instead of "red heat" is a discovery recently announced to the National Academy of Sciences by Prof. E. L. Nichols of Cornell University. The substance which turns blue when heated is germanium oxide, a very rare material.

Prof. Nichols heated some of it to make a study of its radiations and found that when raised to the temperature at which a stove poker would begin to turn red it began to glow with a blue light. As it got hotter, however, it lost its blue hue by degrees, and when near to its melting point behaved like other substances and glowed with a real "red heat". But redness was not reached until far above the temperature sufficient for it with other materials.

TUBERCULOSIS DEATHS DROP IN MARCH

A low tuberculosis death rate for March following high levels for the two pr ceding months is the most encouraging single item in the health record for last month as shown by statistics of the Industrial policyholders of the Metropolitan Life Insurance Company. It was only 124.2 per 100,000 as compared with 132.5 fo March of last year.

"In January and February of this year higher death rates for this disease wer observed than for the first two months of last year," explained Dr. Louis I. Dubli statistician, "and it was feared that the continuous decline in the death rate tha has been observed in recent years might be destined for a check in 1923. It now appears that this unsatisfactory situation was only temporary and that the relativ ly high tuberculosis mortality of the first two months was probably only incidenta to the 1923 influenza epidemic, as influenza generally operates to hasten the deaths of tuberculous persons. The indications are, therefore, good that 1923 will show a continued drop in the mortality from tuberculosis."

HIGH FEVER HOAX INSPIRES IMITATIONS

High fever deceptions are becoming epidemics, according to information reaching officials of the American Medical Association. This is considered an aftermath of the wide publicity given the exploits of a young woman in Escanaba, Mich., who used a hot-water bottle to produce a very high readings of her doctors' clinical thermometers.

In one case in Texas, a prisoner in the jail held hot water in his mouth sufficient to raise the mercury column several degrees. A physician from Kansas reports that three cases have occurred in their hospital in which patients attempted the deceptions with hot-water bottles, and recently a Chicago physician had a patient who faked a fever by the hot-water bottle method.

The power of suggestion is strong, the officials say.

The Mexican Government has completed a motion picture film descriptive of Mexican resources and industries.

A French newspaper proposes to give a prize of 25,000 francs to the aviator who makes the first successful single flight across the English Channel and back again without using more than five and a quarter pints of gasoline.

Parsonite, a new radioactive mineral, was recently discovered in ores from the Belgian Congo.

In a recent campaign in Virginia, 670,993 rats were killed in one week.

The American people are the greatest poisoners in the world, using annually something over 12,000 tons of white arsenic, largely for poisoning boll-weevils.

True lions once roamed in California which were one-third larger than the biggest African lion of today.

The largest of the three